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PATENT
Docket No. P1580

APPARATUS AND METHOD FOR SECURING OBJECTS

REFERENCE DOCUMENT

[0001] This application is related to the subject matter submitted in the following Document Disclosures to the Commissioner for Patents on January 18, 2003, entitled "YANG-KEY", "YANG-KEY ROLLER", and "YANG-KEY DRIVER".

TECHNICAL FIELD

[0002] This invention relates to an apparatus and method for securely binding two or more objects to each other or to adjacent surfaces. More particularly, the present invention relates to a rotating apparatus that, when rotated, automates the process for securely binding two or more rod-like objects together, thereby saving a user time, minimizing the effort required, and reducing the cost of assembly.

BACKGROUND ART

[0003] Present systems for tying or binding two or more objects together involves a labor intensive process. In one instance, several objects such as boxes need to be bound together for shipment or delivery purposes. In this instance, boxes are presently bound together using plastic sheeting, string, rope, or cable that is manually wrapped around a box. The more boxes that need to be bound together to an assembly, such as a pallet, the more manual labor is required for securing these objects. In another example, as shown in Figure 1A, during building construction, as a construction worker prepares a portion of a building foundation for pouring concrete, steel reinforcement rods, hereafter also "rebar" 12, 14, are strategically positioned within a wooden mold 10 to assist in forming the desired shape and increase the strength of a proposed concrete structure 13. Further, rebar 12, 14 need to be secured to each

other to prevent their separation when the concrete is poured into the wooden mold 10. Common concrete structures include freeway underpasses, sidewalks, building foundations, or the like requiring thousands of such connections.

[0004] Figure 1B shows rebar 12, 14 secured to each other using tie wire 18. The present method for securing rebar 12, 14 involves a first step of wrapping tie wire 18 around rebar 12,14 using a hand tool 17, such as a curved tool, to manually twist tie wire 18 until rebar 12, 14 are securely bound to each other.

[0005] This manual wrapping process becomes a safety issue because the twist tie wire 18 may break during the securing process; thus, a broken tie wire may cause eye or limb injuries to workers engaging in twisting tie wires together. The manual wrapping process is slow because each tie wire 18 has to be individually manually twisted together so it would take several workers multiple hours to twist several hundred tie wires. Not only is the manual wrapping process slow, but the process becomes a labor intensive task for large structures, such as foundations for multi-story structures. In such structures, there are thousands of segments of rebar that need to be secured to either a neighboring segment of rebar and/or to several other rebar segments, when multiple perpendicularly positioned rebar segments are joined together. Furthermore, using a manual wrapping twisting process may not adequately secure a neighboring segment of rebar to several other rebar segments because, depending on the physical parameters of the rebar segments to be joined together, i.e., diameter, weight and the length of the rebar segments, manual twisting force simply may be inadequate to provide enough or a uniform tension on all tie wires.

[0006] Therefore, it would be beneficial to provide an apparatus and method for automating the twist tying process. Other benefits of the apparatus and method include uniformly binding together two or more objects utilizing an automated securing process, thereby decreasing the need for intensive manual labor and related cost, increasing productivity and uniformity of joints by controlling the twisting force applied to the material used for binding two or more objects together and providing means for achieving uniformity of tension which binds them together.

DISCLOSURE OF THE INVENTION

[0007] Accordingly, the present invention provides an improved process for binding two or more objects together. The present invention includes an apparatus to provide a twisting force to both ends of a flexible elongate binding member, such as a wire, while the middle is disposed around the object to be bound. The rotating apparatus, which can be similar to a drill motor, also includes a shaft member for receiving and responding to a machine controllable rotational force and a distal end comprising a curved receiver for coupling to and applying machine controllable rotational force to the ends of a flexible elongate binding member. The rotating apparatus has at one end a curved receiver and at the other end is attached to a machine or a device providing a rotational force.

[0008] To begin the binding procedure, the first and the second ends of the flexible elongate binding member, such as wire, are connected to the curved receiver located at the distal end. The flexible elongate binding member is wrapped around two or more objects. Thereafter, the flexible elongate binding member is twisted by the curved receiver in response to a machine controllable rotational force applied to said shaft member until the flexible elongate binding member tightly wraps around the two or more objects, thus, securely binding the objects together. In this embodiment, the curved receiver has a radius of curvature that forms a hook for coupling the first end and the second end of the elongate flexible binding member. In this embodiment, the flexible elongate binding member could be cable, strap, string, rope, a piece of yarn, a plastic containing compound member, or the like.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] For a better understanding of the present invention, reference is made to the below drawings. Reference numbers refer to the same or equivalent parts of the present invention throughout the several figures of the drawings.

[0010] Figure 1A is a preform for concrete located at a construction site.

[0011] Figure 1B shows the securing of two objects using a hand tool.

[0012] Figure 2A is a front elevation view of a rotating apparatus for the first embodiment of the present invention.

[0013] Figure 2B is a bottom view of a shaft member for rotating apparatus for a first embodiment of the present invention.

[0014] Figure 3 is a front view of a flexible binding member that is twisted by a rotating apparatus for the first embodiment of the present invention.

[0015] Figure 4 is a side view for a rotating apparatus connected to a standard drill chuck and to a flexible binding member for the first embodiment of the present invention.

[0016] Figure 5 is a side view for a flexible binding member rotated by a standard drill chuck about two or more objects for the first embodiment of the present invention.

[0017] Figures 6A is a sideview of a second embodiment of the present invention.

[0018] Figure 6B is an exploded view of the Figure 6A embodiment.

[0019] Figure 7 is a third embodiment of the present invention illustrating an electric driver used in conjunction with the rotating apparatus.

[0020] Figure 8 is a flow chart for binding two objects for the first embodiment of the present invention.

MODES FOR CARRYING-OUT THE INVENTION

[0021] The present invention is an apparatus and method for tying two or more objects together. The present invention includes a rotating apparatus and method that decreases required labor and time for binding two or more objects together or to another assembly. The present invention provides other advantages over other object binding methods such as portability, so that the rotating apparatus may be used in remote locations, and ease of removal of the rotating apparatus once the binding process is completed. Furthermore, this rotating apparatus and method may be used to secure a multitude of objects to each other or to other assemblies such as walls, floors, or pallets. For example, the multitude of objects may include boxes, pieces of yarn, electrical wires, steel rods and pieces of rebar. The apparatus and method is described for a binding multiple segments of rebar typically used in the foundation of a newly constructed building.

[0022] Figure 2A is a front elevation view of a rotating apparatus 19 of a first embodiment of the present invention. Rotating apparatus 19 includes a shaft member 24 for receiving and responding to a rotational force. Rotating apparatus 19 further includes a distal end 16 that is a curved receiver 20 for applying a rotational force to the flexible binding member (not shown in the Figure). The rotational force is provided by a machine such as a drill or the like attachable to end 28 of rotating apparatus 19. A user may either manually select or use a pre-

programmed rotational force. Curved receiver 20 includes a hooked tip 29. Hooked tip 29 has a radius of curvature 31 adapted for coupling to a first end and a second end of a flexible elongate binding member (not shown in the Figure). Hooked tip 29 has a radius of curvature 31 that subtends an angle 33 of approximately 120 degrees relative to shaft member 24. In the alternative, hooked tip 29 may have a radius of curvature 31 that subtends an angle 33 relative to shaft member 24 selected from a range of 22 degrees to 180 degrees with a preferred range of approximately 45 degrees to approximately 120 degrees. Curved receiver 20 further includes a round base 22 for providing a mechanical connection between curved receiver 20 and shaft member 24. Hooked tip 29 has a height 27 selected from a preferred range of approximately 0.8 inches to approximately 2 inches, and further hooked tip 29 has a width 30 selected from a preferred range of approximately 0.8 inches to approximately 2 inches. In an alternative embodiment, curved receiver 20 may have no round base 22 and curved receiver 20 attaches directly at one end to shaft member 24 (not shown in Figure).

[0023] Figure 2B is a bottom view for rotating apparatus 19 for the Figure 2A embodiment of the present invention. In this embodiment, shaft member 24 has a shaft member radius 23 selected from a range of approximately 1/8 to 7/8 of an inch with a preferred range of approximately 1/4 of an inch to approximately 1/2 of an inch. Round base 22 has a diameter 35 selected from a preferred range of approximately 0.8 inches to approximately 2 inches. In this embodiment, shaft member 24 has at least one shaft end 28 that is hexagonally shaped, but shaft member 24 may be any shape that mates with a machine or a device that provides rotational torque.

[0024] Figure 3 is a front view of an flexible elongate binding member 32 that is twisted by rotating apparatus 19 (shown in Figure 2A). Flexible elongate binding member 32 includes a first end 28 and a second end 30. First end 28 is a loop for coupling to curved receiver 20 (shown in Figure 2A). Second end 30 is a loop for coupling to curved receiver 20 (shown in Figure 2A). Flexible elongate binding member 32 is twisted by rotating apparatus 19 (shown in Figure 2A). In this embodiment, flexible binding member 32 is tie wire. In the alternative, flexible binding member 32 may be any bendable member such as wire, cable, strap, string, rope, strap, yarn, electrical wire, plastic sheeting, or the like. Flexible elongate binding member 32 wraps around two or more objects and couples to curved receiver 20 (shown in Figure 2A) at said first end 28 and second end 30 (not shown in this Figure).

[0025] Figure 4 is a side view of a rotating apparatus 19 connected to a drill chuck 34 and to flexible elongate binding member 32. In this Figure, flexible elongate binding member 32 wraps around a first object 40, such as a first rebar, and a second object 42, such as a second rebar. Flexible elongate binding member 32 connects to curved receiver 20 at first end 28 and second end 30. In this embodiment, first object 40 and second object 42 are segments of rebar, where rebar is a steel reinforcing rod. The twisting of flexible elongate binding member 32 is accomplished by a rotational force 45 applied at first end 28 and second end 30 until flexible elongate binding member 32 assembly area pushes against first object 40 and second object 42, binding together first object 40 and second object 42. A machine controllable rotational force 45 is provided by a standard drill 38, wherein shaft member 24 is received by a standard drill chuck 34. Alternatively, the standard drill 38 may be any drill and standard drill chuck 34 may be any chuck which are functionally equivalent. Further, curved receiver 20 is adapted to be removable from flexible elongate binding member 32, so that a user may quickly, after completing binding first object 40 and second object 42, connect additional rebar segments, such as a third rebar and a fourth rebar segment, with an additional flexible elongate binding member (not shown in Figure). The additional flexible elongate binding member securely binds the additional rebar segments analogously using the above disclosed rotating and connecting principles.

[0026] Figure 5 is a side view showing a flexible elongate binding member 32 twisted by a standard drill chuck 34 about objects 40, 42. This figure shows the result of twisting flexible elongate binding member 32 as described in Figure 4. In this embodiment, a rotating device, such as a standard drill motor 38, or the like, connects to the present invention rotating apparatus 19 to produce the unexpected result of achieving improvements for binding two or more objects, compared with prior art hand tools, because repeatable tension can be achieved using one rotating device or multiple rotating devices with similar tension settings. Furthermore, the present invention apparatus and method produce the unexpected result of allowing a user to increase productivity of binding two or more objects because a standard electric drill 38 connected to rotating apparatus 19 twists a wire using a minimal amount of manual labor and decreases time required per each binding operation. Additionally, rotating apparatus 19 of the present invention has the advantage of minimal set-up time for next binding operation, because the present invention hook tip is easily disconnected from a flexible

elongate binding member that has been twisted using the above described procedure.

[0027] Figure 6A is a sideview of a second embodiment of the invention. In this, a user's hand (not shown in Figure) grips a hollow sleeve 51 while a rotational force is applied to end 24 of rotating apparatus 19. Other components include clip 36A for securing a first bearing 53 against hollow sleeve 51 and a clip 37A for securing a second bearing 55 against hollow sleeve 51. As such, when flexible elongate binding member 32 (not shown in Figure) is twisted by curved receiver 20 (not shown in Figure), similar to as described in Figure 5, hollow sleeve 51 provides a non-rotating external grip, allowing a user an improved method to control the operation and the removal of rotating apparatus 19 (not shown in Figure) through having an external grip proximally located to rotating apparatus 19 while machine controllable rotational force is applied to the shaft member 24.

[0028] Figure 6B is an exploded view of the 6A embodiment. It shows the internal mechanisms of the hollow sleeve 51. Hollow sleeve 51 includes a hollow sleeve first end 56 and a hollow sleeve second end 59. Hollow sleeve first end 56 pushes against a first outer ring 52A of first bearing 53. First bearing 53 is mechanically connected to shaft member 24 using clips 36A, 36B that press against first inner ring 52B. Additionally, hollow sleeve second end 59 pushes against a second outer ring 54A of second bearing 55. Second bearing 55 is mechanically connected to shaft member 24 using clips 37A, 37B which press against second inner ring 54B of second bearing 55.

[0029] Figure 7 shows an electric driver used in conjunction with the rotating apparatus for the third embodiment of the present invention. In this Figure, rotating apparatus 19 is connected to electric driver chuck 61 of an electric driver 67. In this embodiment, electric driver 67 is a battery-powered screw driver, wherein the battery (not shown) is recharged using recharging base portion 66. Further, in this embodiment, a user presses on/off switch 64 to the on position to turn on the electric driver motor (not shown in Figure) to commence twisting of flexible elongate binding member 32. A clutch 62 feature allows a user to select one of four torsional settings allowing user flexibility for adjusting the tightness for twisting flexible elongate binding member 32. Clutch feature 62 allowing a user to custom tailor a tension level for binding together first object 40 and second object 42. The third embodiment operates and functions similarly to the disclosed first embodiment of the present invention. As such, this embodiment demonstrates that a rotating apparatus 19 may be used with a standard

electric screwdriver. In the alternative, an electric driver and a rotating apparatus may be one product that is sold together in one package.

[0030] Figure 8 is a flow chart for binding a first object and a second object of the present invention. The method as described is for binding first object and second object using a flexible elongate binding member having a first end and a second end. Step 70, inserting a shaft member of rotating apparatus end into a drill chuck or the like. Step 72, twisting the flexible elongate binding member around a first object and a second object. Step 74, coupling a curved receiver to first end and second end. Step 76, inserting a distal end of rotating apparatus having a first end including a shaft member into a drill chuck. Step 78, wrapping the flexible elongate binding member in response to a rotational force applied to the drill chuck, causing curved receiver to twist until first object and second object are securely bound together with flexible elongate binding member. Step 80, removing the curved receiver from the first end and the second end for coupling the curved receiver to an additional flexible elongate binding member, i.e., a second flexible elongate binding member.

[0031] Step 82, wrapping an additional flexible elongate binding member, such as a second flexible binding member, having the first end and the second end around additional objects. Step 84, connecting the rotating apparatus with the curved receiver to the first end and the second end. Step 86, rotating the curved receiver using drill chuck until additional objects are securely bound together. The process is repeated until all objects desired are bound.

[0032] In yet another application, the above described rotating apparatus may be used to twist together separate pieces of yarn. In this other application, loops, similar to the loops on a flexible elongate binding member described above, are created at the ends of the yarn pieces. Afterwards, as described in first embodiment, these loops are connected to a curved receiver as described above. Following, as described above, a rotational force applied to the rotating apparatus causes the pieces of yarn to twist together, thus, binding together the pieces of yarn. Finally, to finish the twisting process, loops created at the end of the yarn pieces are removed from the curved receiver, and tied together using a knot, a metal clip, or the like. In yet another application of the present invention, electrical wires may be twisted together to create a wire harness such as that used by car stereo installers, similar to the above steps for twisting together pieces of yarn. As such, the present invention would automate the process for stereo installers creating a wire harness wherein a multitude of electrical wires may be combined in

one harness without the need, as in prior art methods, for hand wrapping wires to each other. The present invention would also provide other advantages such as user defined tension setting, that may be uniform or changed, during the twisting operation.

[0033] Information as herein shown and described in detail is fully capable of attaining the above-described object of the invention and the present embodiment of the invention, and is, thus, representative of the subject matter which is broadly contemplated by the present invention. The scope of the present invention fully encompasses other embodiments which may become obvious to those skilled in the art, and is to be limited, accordingly, by nothing other than the appended claims, wherein reference to an element in the singular is not intended to mean "one and only one" unless explicitly so stated, but rather "one or more." All structural and functional equivalents to the elements of the above-described embodiment and additional embodiments that are known to those of ordinary skill in the art are hereby expressly incorporated by reference and are intended to be encompassed by the present claims.

[0034] Moreover, no requirement exists for a device or method to address each and every problem sought to be resolved by the present invention, for such to be encompassed by the present claims. Furthermore, no element, component, or method step in the present disclosure is intended to be dedicated to the public regardless of whether the element, component, or method step is explicitly recited in the claims. However, one skilled in the art should recognize that various changes and modifications in form and material details may be made without departing from the spirit and scope of the inventiveness as set forth in the appended claims. No claim herein is to be construed under the provisions of 35 U.S.C. § 112, sixth paragraph, unless the element is expressly recited using the phrase "means for."

INDUSTRIAL APPLICABILITY

[0035] The present invention applies industrially to a rotating apparatus and method for securely tying together objects to each other. More particularly, the present invention applies industrially to an apparatus that, when a rotational force is applied, automates the process for securely binding several objects together or to a pallet, thereby saving a user time, minimizing a user's required effort, and providing uniform tension and improving productivity and thereby reducing cost.